

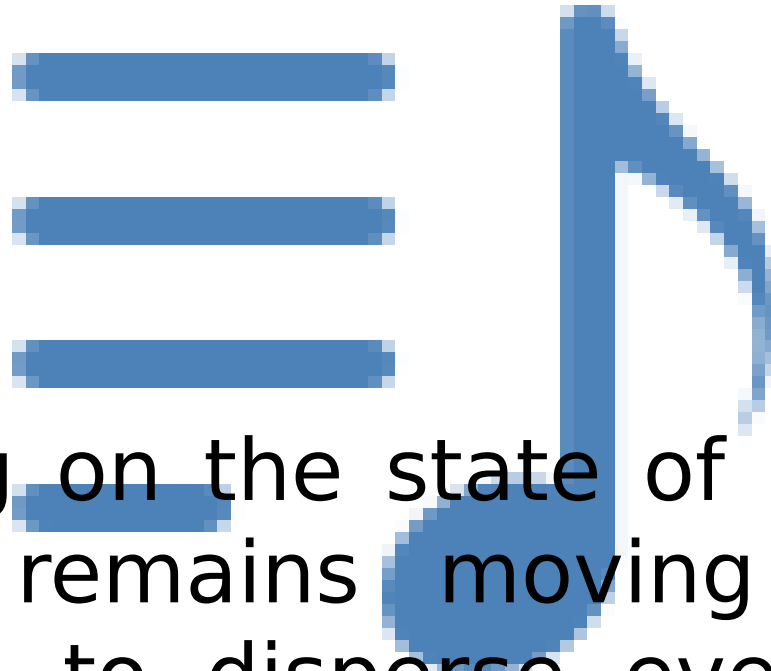
Interstitial Fluid

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- ▶ The interstitial fluid is the product of diffusion and osmosis through the walls of capillaries toward the interstitial space.
 - ▶ Most components of blood plasma, such as nutrients, gases, and hormones, filter freely through the capillary walls to form interstitial fluid and available to the cells.
 - ▶ The specific characteristic of capillaries allow this flow of fluid and dissolved substances.



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- ▶ Diffusion
 - ▶ Osmosis
 - ▶ Capillary structure
 - ▶ Interstitium





Depending on the state of matter the molecule remains moving randomly and tends to disperse evenly in the available system volume due to their random movement.

When we are talking about the membrane-bounded structures like cells, diffusion works for the molecule for which the membrane is permeable.

This movement takes place from the site of higher concentration to the lower concentration either in a free system or across a semipermeable membrane.

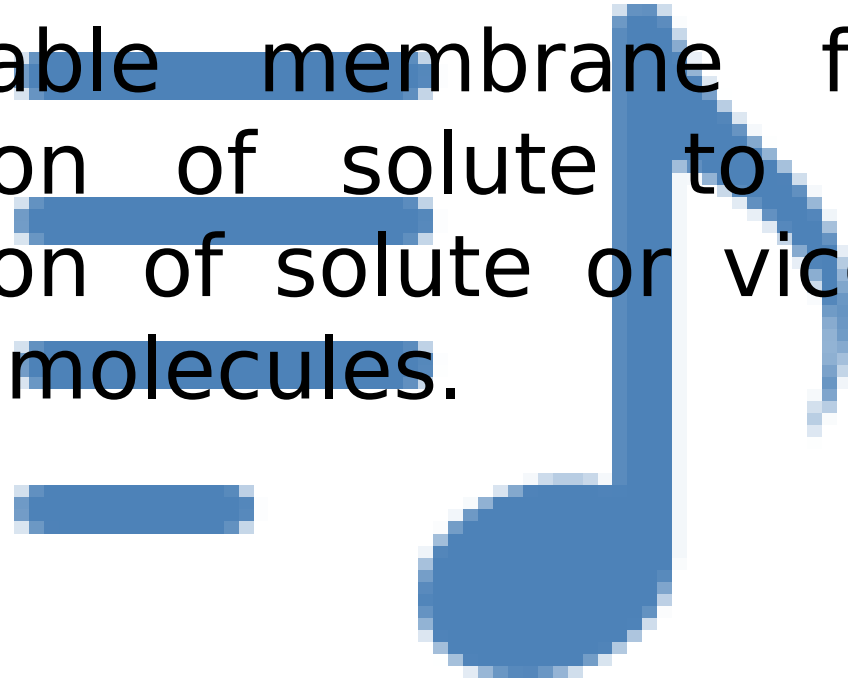


The molecules for which the membrane is not permeable e.g. due to their size or polarity, remains restricted to either side of the membrane, that is why the membranes are called semipermeable.

These restricted molecules decrease the relative ratio of the free solvent molecule on their site across the membrane and the solvent molecules follow the concentration gradient.



The solvent molecules move across semipermeable membrane from lower concentration of solute to the higher concentration of solute or vice versa for the solvent molecules.



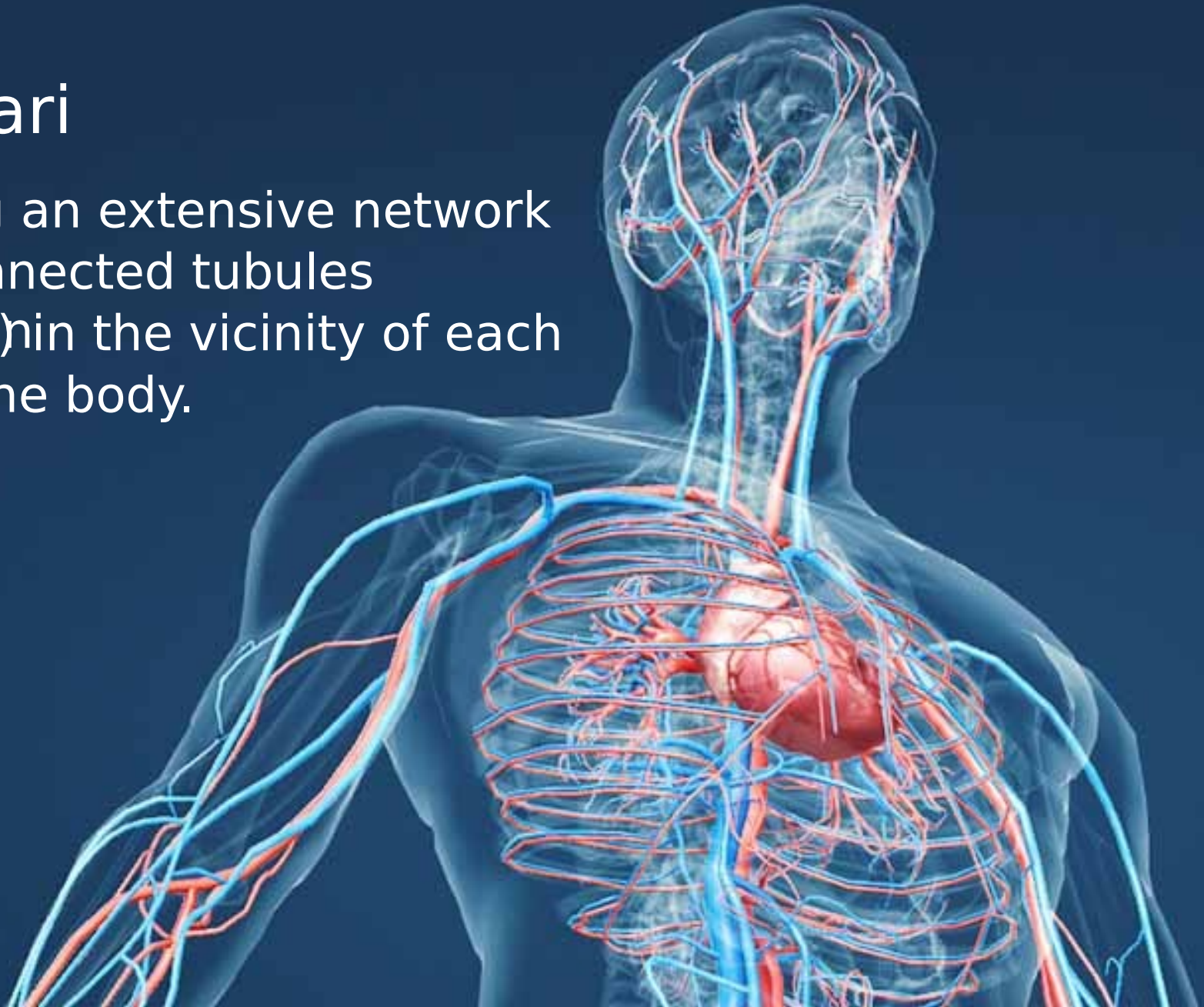
Capillari

es
Are the smallest of the blood
vessels.



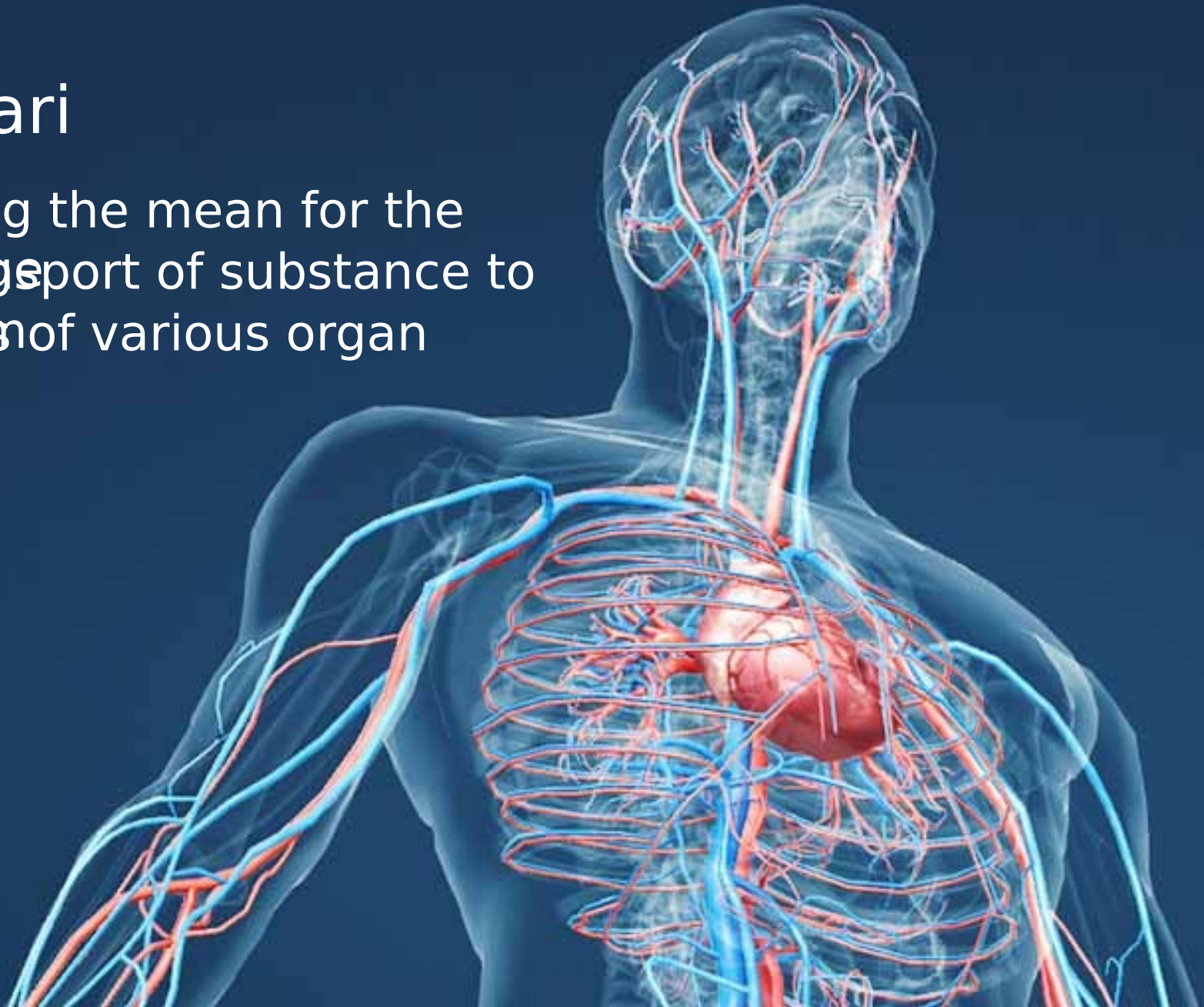
Capillaries

Forming an extensive network of interconnected tubules (20 billion) in the vicinity of each cell of the body.



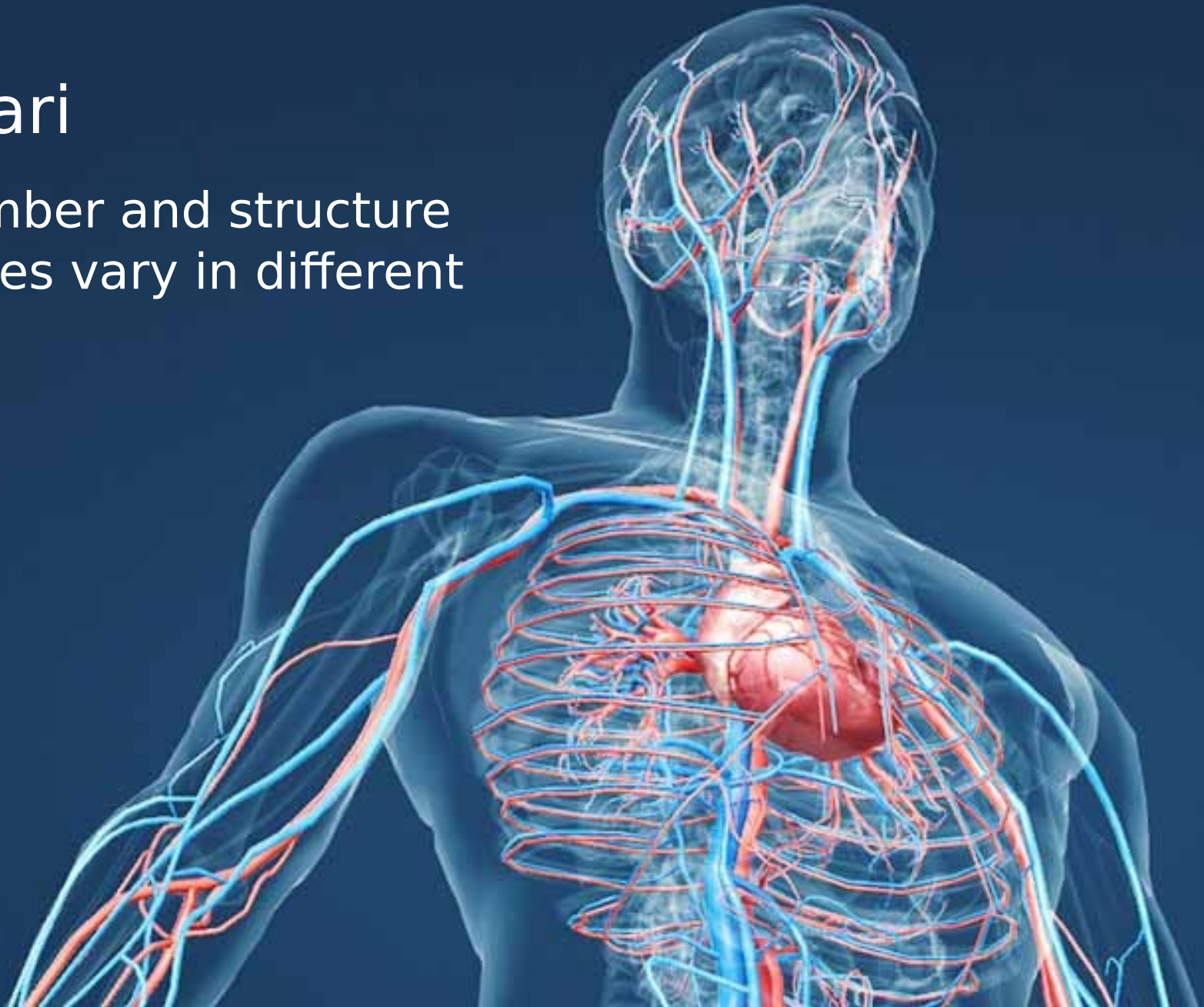
Capillari

es
Providing the mean for the
exchange of substance to
the cells of various organ
system.



Capillaries

The number and structure of capillaries vary in different organs.



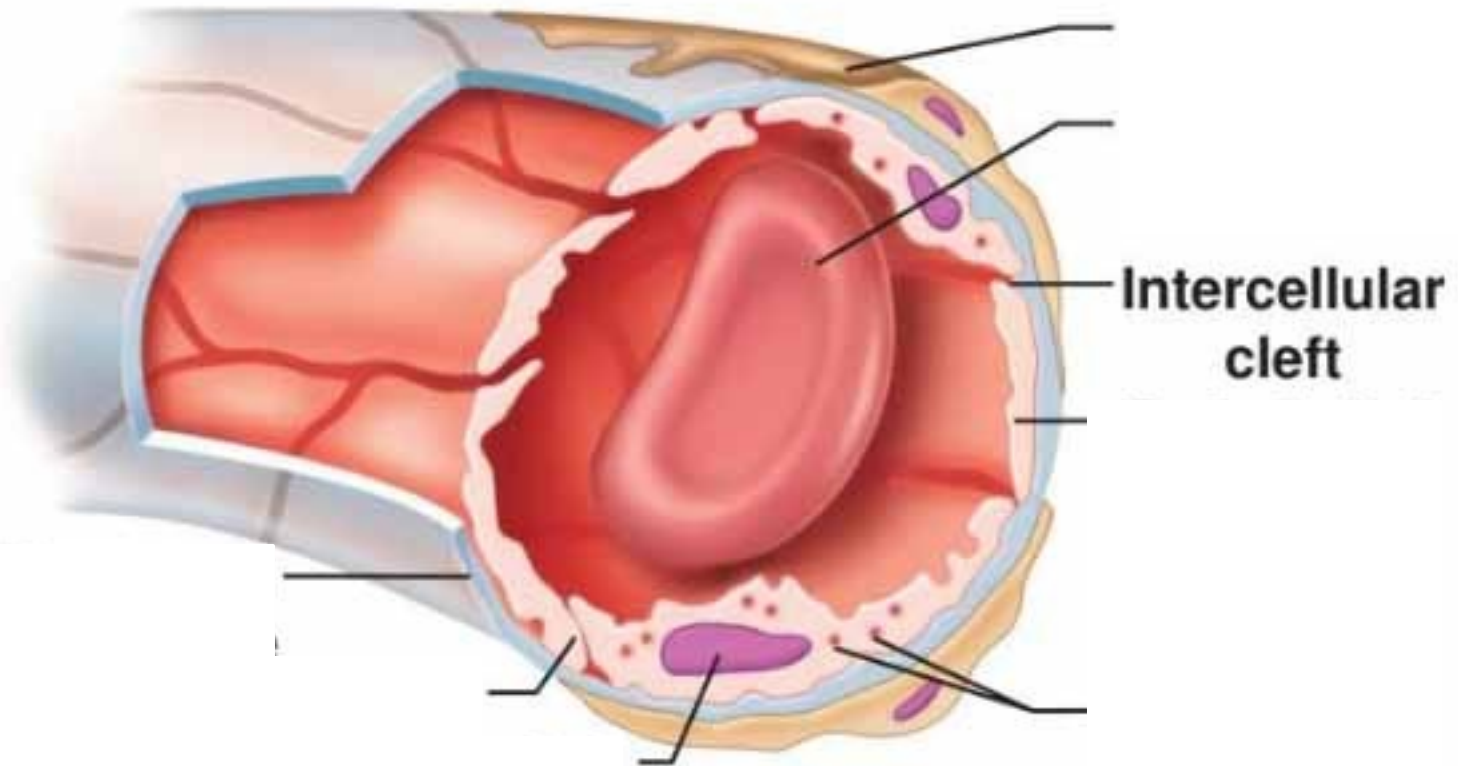
Capillaries

The capillaries are identified as

Based on their wall's structure which affects the ease with which the exchange of substances can take place .



Continuous capillaries



Continuous capillaries

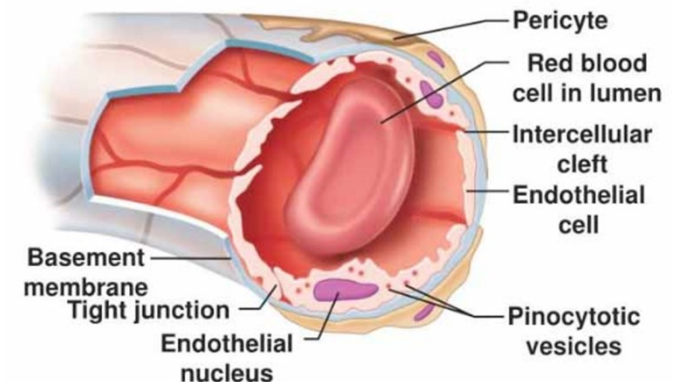
The most common type of capillary

Found in almost all vascularized tissues.

Characterized by a complete endothelial lining with tight junctions between endothelial cells.

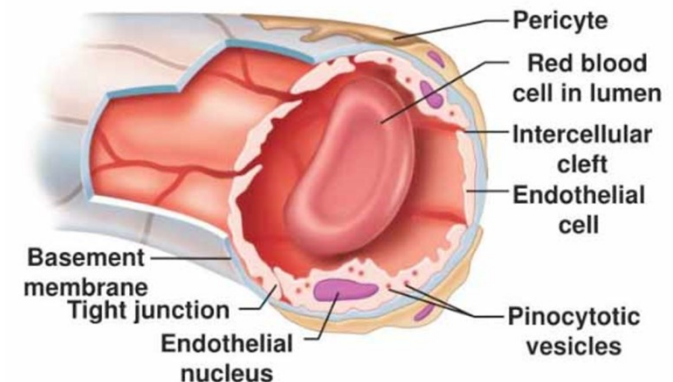
Although a tight junction is usually impermeable and only allows for the passage of water and ions.

They are often incomplete in capillaries, leaving **intercellular clefts** that allow for exchange of water and other very small molecules between the blood plasma and the interstitial fluid.

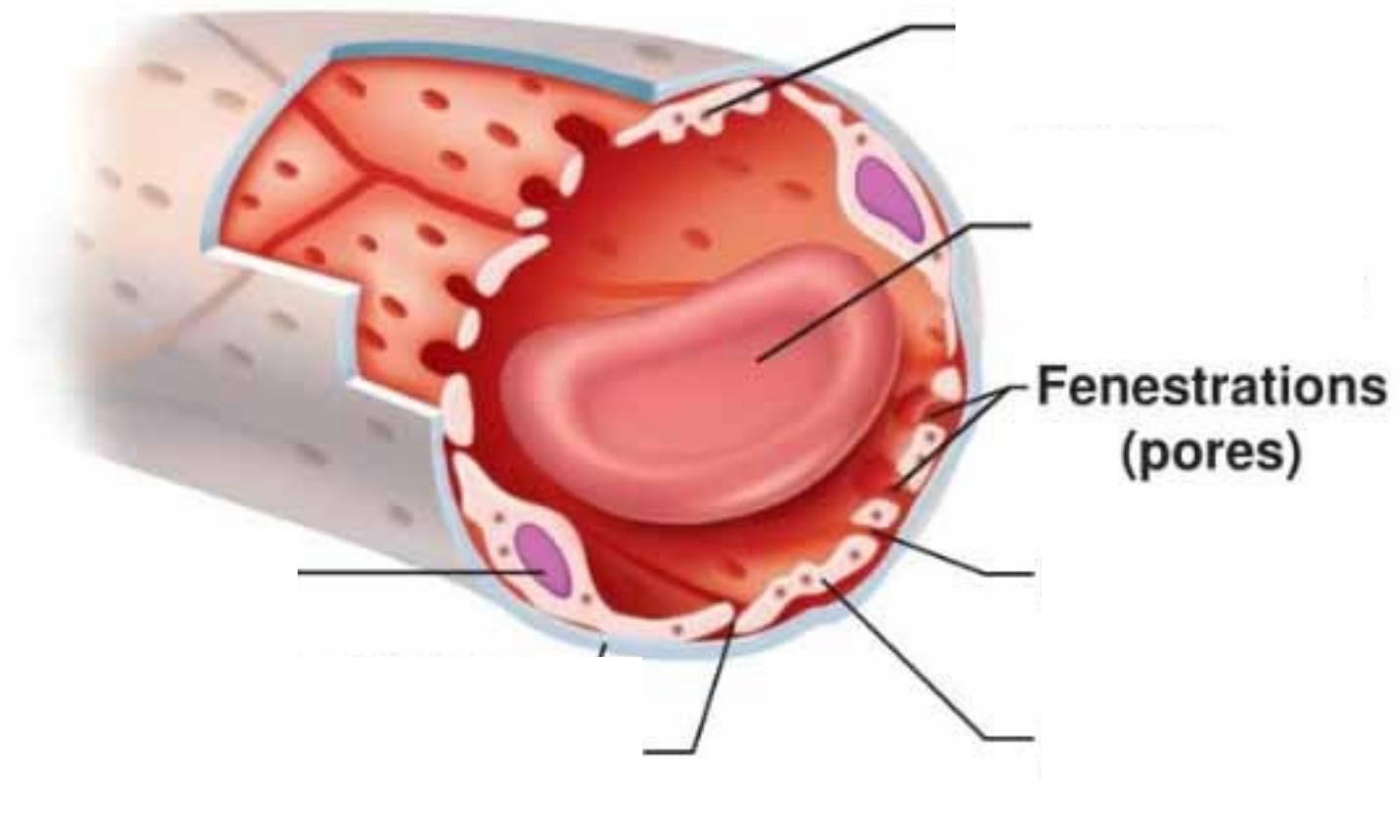


Continuous capillaries

Substances that can pass between cells include metabolic products, such as glucose, water, and small hydrophobic molecules like gases and hormones, as well as various leukocytes.



Fenestrated capillaries

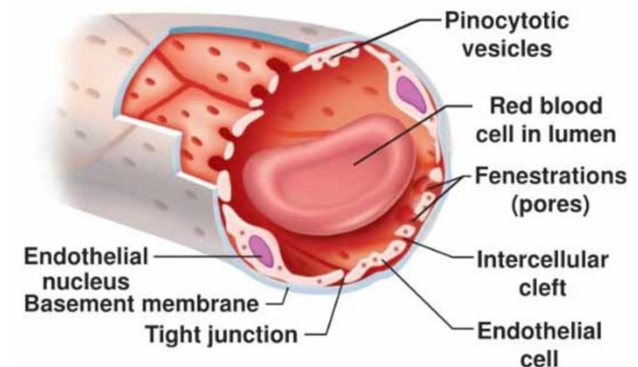


Fenestrated capillaries

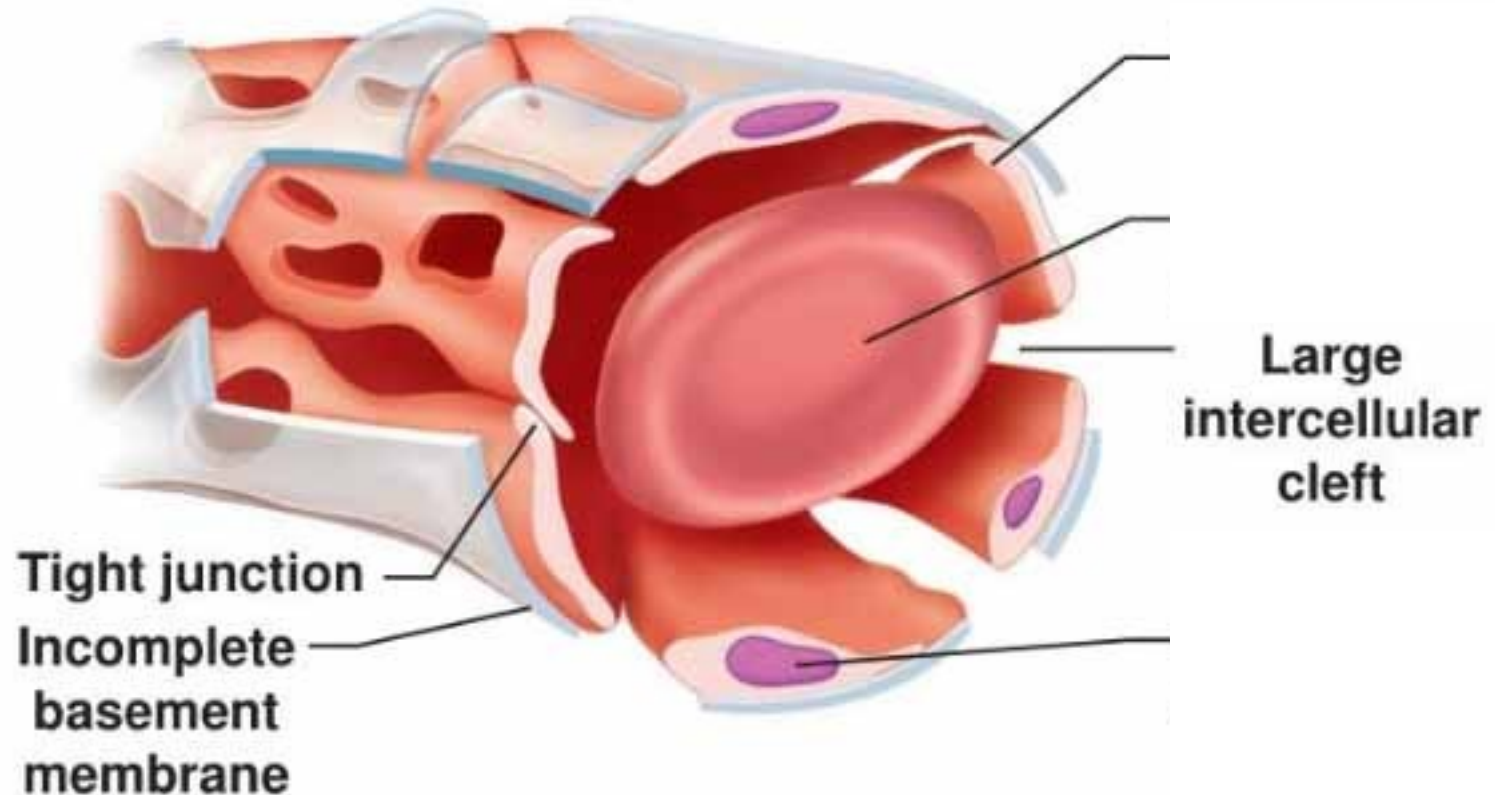
These have pores (or fenestrations) in addition to tight junctions in the endothelial lining, making capillary more permeable.

Fenestrated capillaries are common in the small intestine, which is the primary site of nutrient absorption, as well as in the kidneys, which filter the blood.

They are also found in the choroid plexus of the brain and many endocrine structures, including the hypothalamus, pituitary, pineal, and thyroid glands



Sinusoidal capillaries



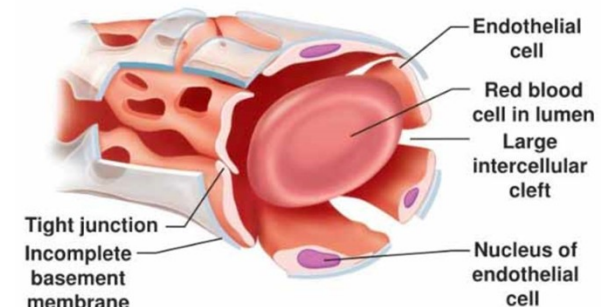
Sinusoidal capillaries

Least common type of capillary.

Extensive intercellular gaps and incomplete basement membranes, in addition to intercellular clefts and fenestrations.

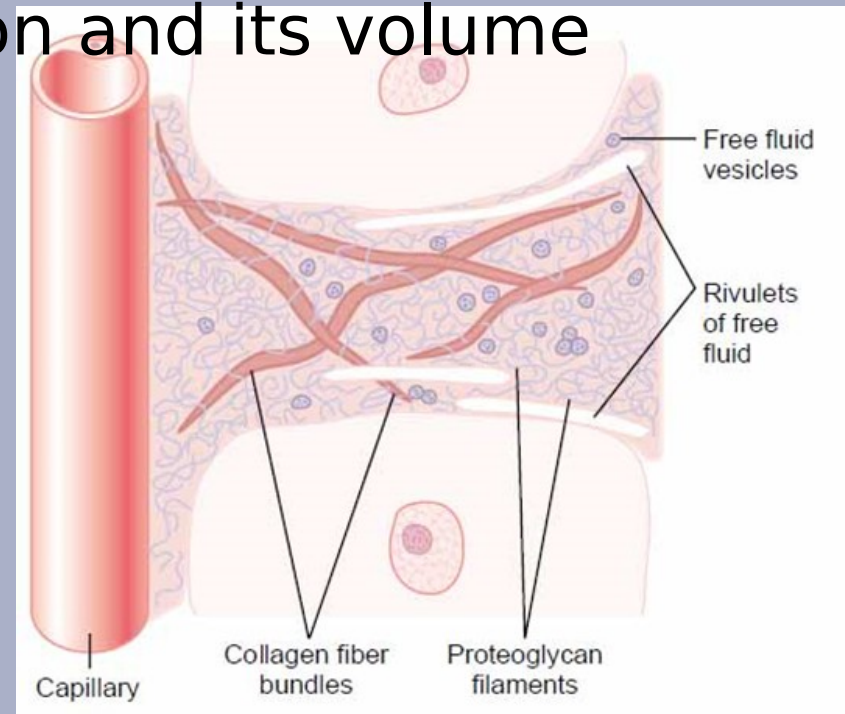
These very large openings allow for the passage of the largest molecules, including plasma proteins and even cells.

Sinusoids are found in the liver and spleen, bone marrow, lymph nodes (where they carry lymph, not blood), and many endocrine glands including the pituitary and adrenal glands.



Interstitium & Tissue gel

The composition of the interstitium, the space between the cells which comprises about 1/6th of the total body volume, plays an important role in the flow of fluid across capillaries, interstitial fluid formation and its volume determination.



Interstitium & Tissue gel

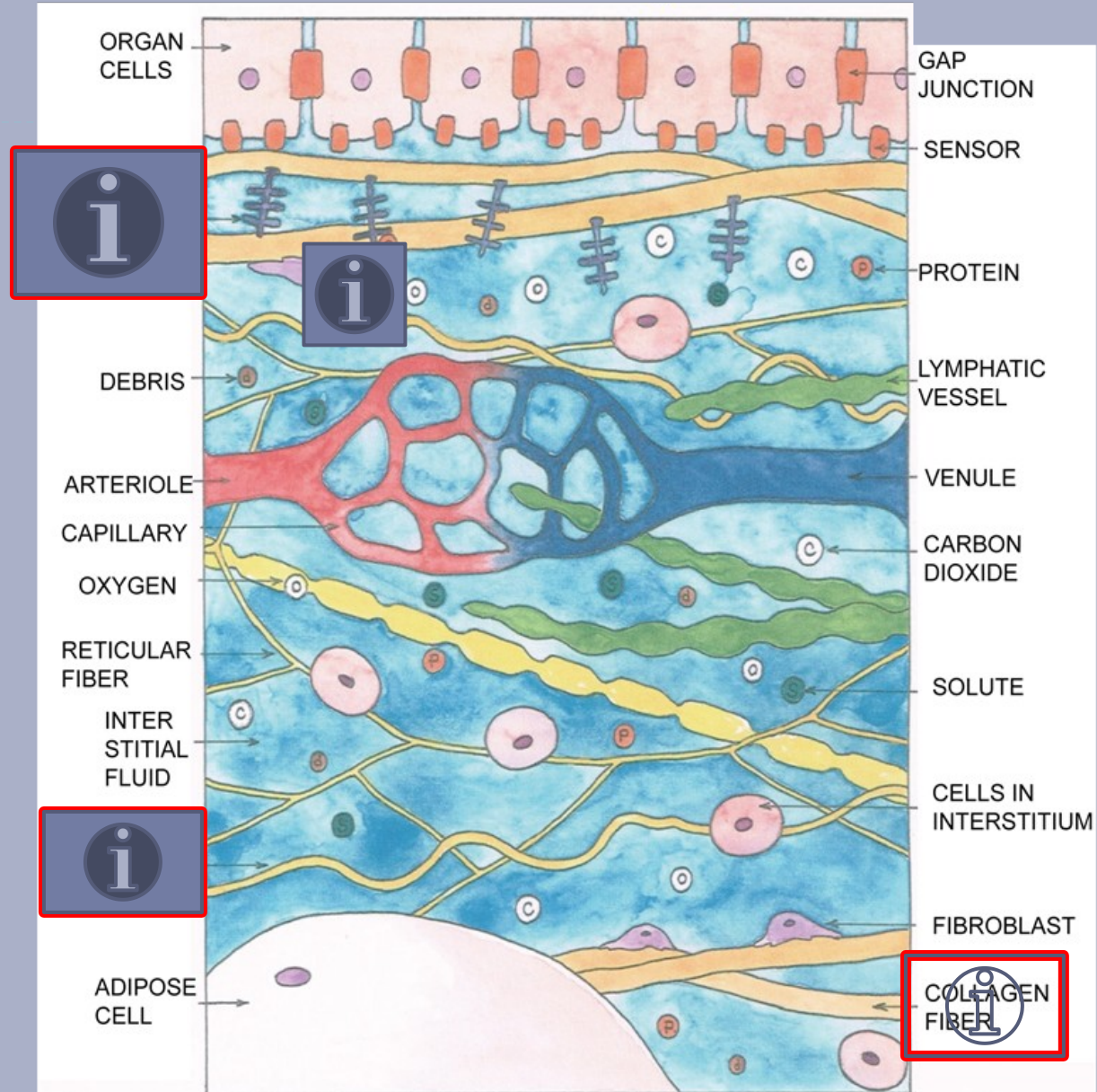
The interstitium is composed mainly of
collagen

elastin

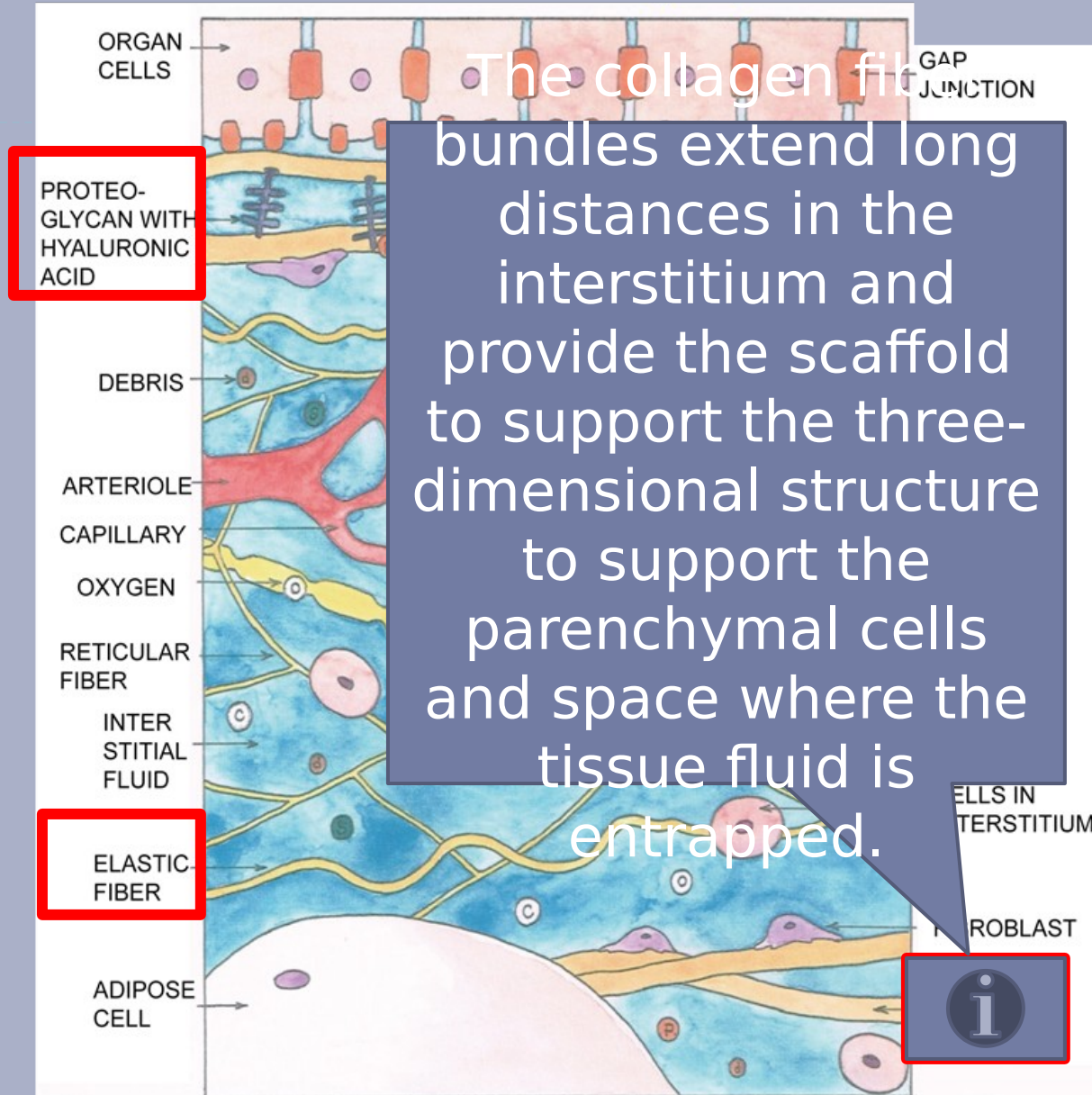
glycosaminoglycans (mucopolysaccharides,
such as hyaluronate and proteoglycans)



Interstitial Fluid (ISF)



Interstitial Fluid (ISF)



Interstitial Fluid (ISF)

Elastin is another major structural component of the extracellular matrix and is one of the most hydrophobic of all known proteins. While Collagen provides the mechanical strength to the tissue space, Elastin confers elasticity to these structures.

PROT
GLYC
HYALU
ACID

ART
CAP
OX
RET
FIBER

INTER
STITIAL
FLUID



ADIPOSE
CELL

GAP
JUNCTION

SENSOR

PROTEIN

LYMPHATIC
VESSEL

VENULE

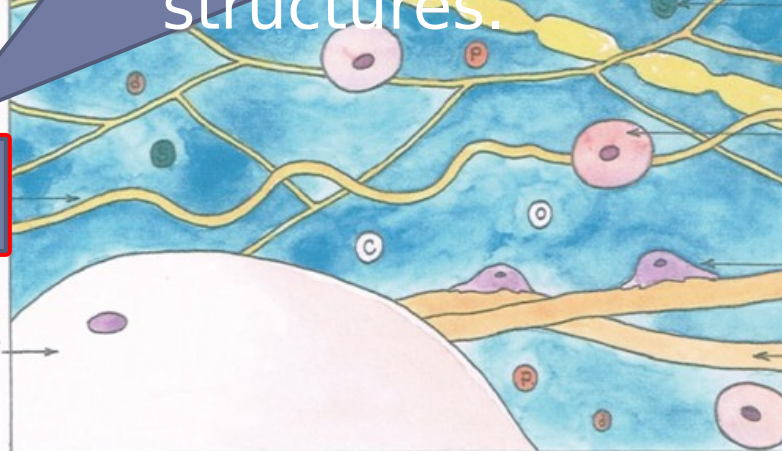
CARBON
DIOXIDE

SOLUTE

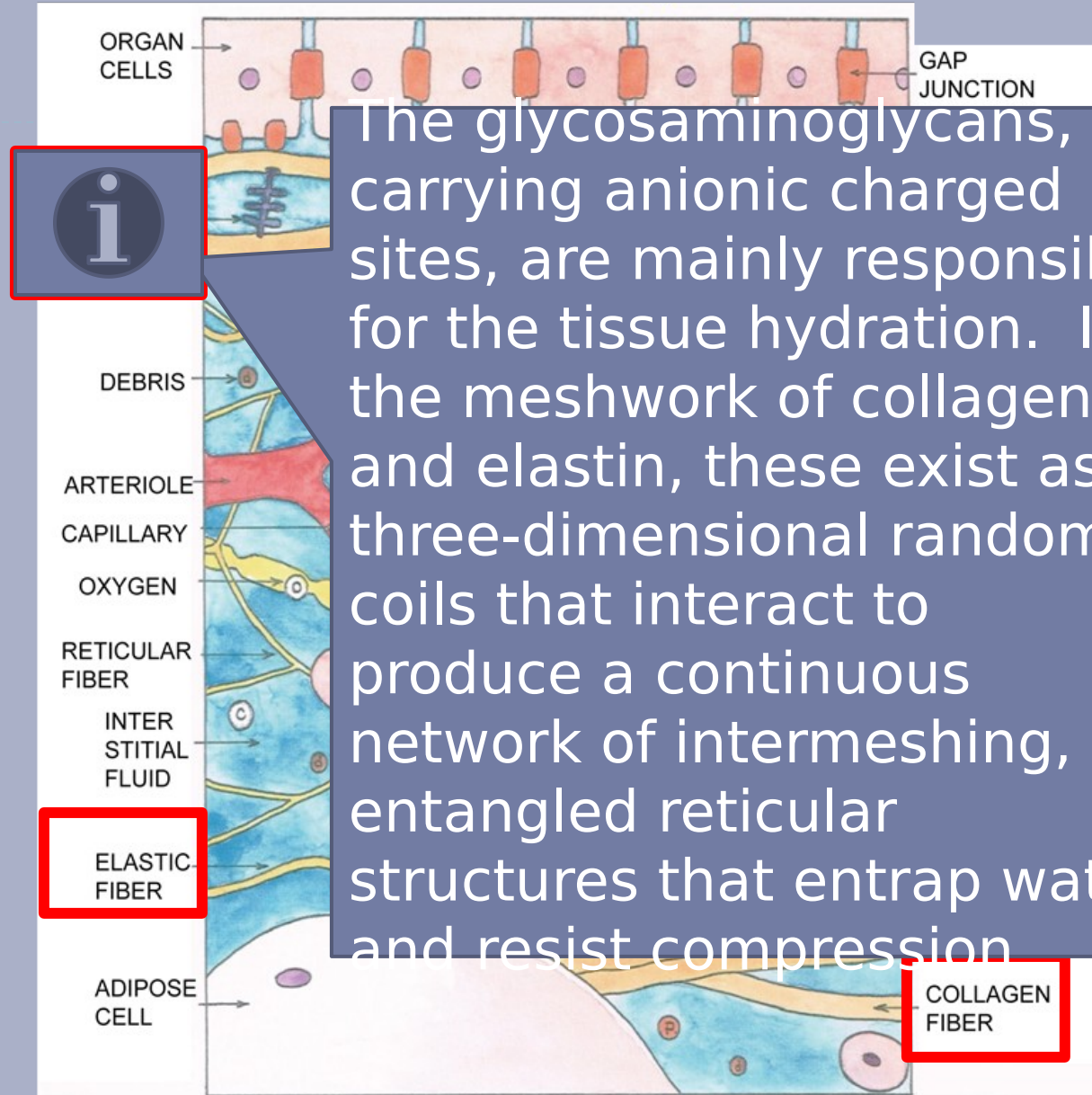
CELLS IN
INTERSTITIUM

FIBROBLAST

COLLAGEN
FIBER

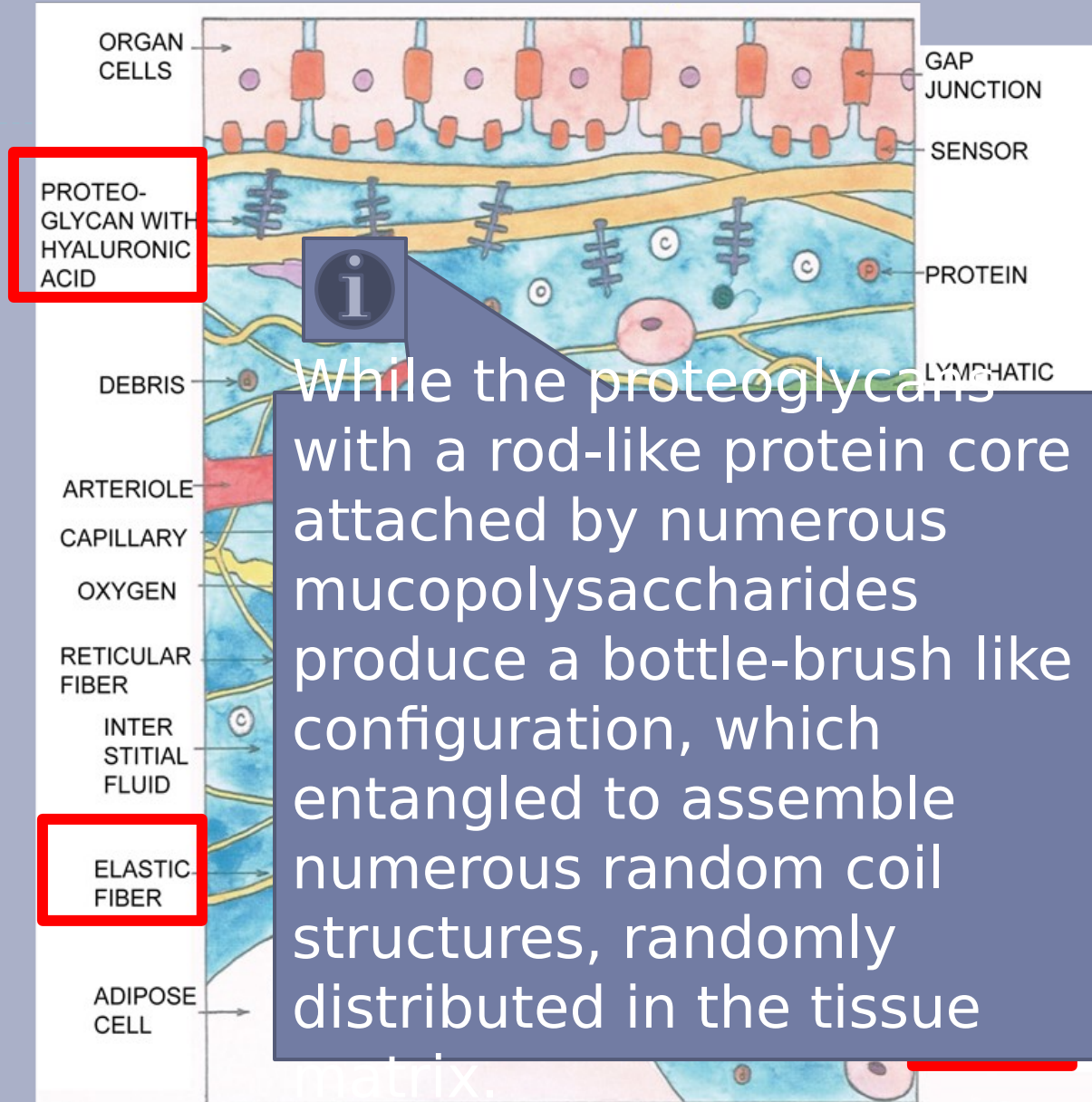


Interstitial Fluid (ISF)



The glycosaminoglycans, carrying anionic charged sites, are mainly responsible for the tissue hydration. In the meshwork of collagen and elastin, these exist as three-dimensional random coils that interact to produce a continuous network of intermeshing, entangled reticular structures that entrap water and resist compression.

Interstitial Fluid (ISF)



Interstitium & Tissue gel

This three-dimensional structural arrangement with mechanical and elastic support, distributed with hydrophobic meshwork imparts the tissue space sponge-like characteristic and provides the mean for the entrapment of water molecules and the substances dissolved in it. This tissue gel provides the hydrated environment to the cells where these can absorb and excrete, this also limit the availability of free water for fluid flow, although **rivulets** of free fluid exist within the space.



